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satellite keeps the same face towards the planet during its revolution and that the marking is always turned away. It would be interesting to see if this feature is a permanent one at the coming October opposition, which will be the nearest approach of the planet in twelve years.

WASHBURN COLLEGE OBSERVATORY, TOPEKA.

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## CELESTIAL PHOTOGRAPHY WITH THE WASHBURN TELESCOPE.

EDISON PETTIT.

**D**URING the past year preparations were made to adapt the Washburn College refractor to celestial photography. Some preliminary attempts showed that the telescope, which has an  $11\frac{1}{2}$ -inch Brashear objective, was capable of producing good photographic images. With this in view, a double-slide plate holder was built in the college shop, which makes accurate guiding possible.

A brass collar fits over the  $4\frac{1}{2}$ -inch draw tube, and to this is attached a brass plate which may be rotated in position angle. To this plate is attached the double-slide plate holder with guiding eyepiece and shifting screws. A plate-carrier opening in the back provides means of bringing the film to exact focus. The cross wires are No. 60 copper and illuminated with a flash-light bulb which receives current from the 11-volt a. c. telescope circuit, and may be adjusted through a potentiometer. The carrier takes 3 by  $3\frac{1}{2}$  in. plates.

With this form of plate holder the guiding is done on the same field of stars that is being photographed, and the corrections to the clock motion are made by shifting the whole plate and not the telescope. The field having been selected, a guiding star is found and set on the cross wires, a plate cut and inserted, and the slide cover drawn. The star is now kept on the cross by manipulating the two shifting screws, which move the plate in two directions at right angles to each other.

To facilitate photographic and other astronomical work the dome has been provided with a  $\frac{1}{2}$  hp. a. c. motor for revolving it. The starting box and reversing switch are placed on the side of the observing ladder, so that the observer need not leave the guiding eyepiece to shift the dome. A centrifugal friction

clutch throws on the load gradually, and gives a slow, steady motion, so that the telescope can be kept centered on the slit.

In order to make the observer entirely free at the guiding eyepiece, the driving clock was provided with an electrical winding device. The falling weight pushes a snap-switch at the end of its fall and starts a small motor receiving current from the 30-volt storage battery. This motor winds the clock through a worm gear, and requires five minutes to do the work. This makes the observer entirely free from the dome and clock, so that he need not leave the eyepiece, no matter how long the exposure.

For comet and nebular photography Seed 30 plates are used. An exposure of an hour and a half on the great nebula of Orion will give good detail. On March 17, 1915, an exposure of  $2\frac{1}{2}$  hours was made on Mellish comet, which showed the three nuclei into which the comet had broken as discovered by Professor Barnard five days earlier.

Plates intended for measurement must be exposed through a color filter which will transmit the visual radiations only, in order to produce sharp images. This filter is made according to the formula of Wallace. This has a bright yellow color and lengthens the time of exposure considerably. The color filter will be used to secure plates of the asteroids, the moon, and for work in visual photographic magnitudes.

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